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Document is subject to modification and will be updated as deemed necessary.

STORM WATER MONITORING GUIDANCE MANUAL

for

MS4 Activities

ARIZONA DEPARTMENT OF TRANSPORTATION

February 1, 2005

Disclaimer

The manual may contain references to equipment, materials, or patented processes by manufacturer, trade name, make, or catalog number. Such references shall be regarded as establishing a standard of quality, finish, appearance, performance, or as indicating a selection based upon compatibility with existing equipment or materials and shall not be construed as limiting selection to a specific item or source.

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1.0 BACKGROUND

In accordance with NPDES permit #AZS000018, issued by the U.S. Environmental Protection Agency (USEPA), the Arizona Department of Transportation (ADOT) was to develop and submit a storm water monitoring plan by September 30, 2000. A monitoring plan was included in ADOT's first annual report that was submitted to USEPA in September 2000. ADOT did not receive any comments or approval of its monitoring plan from USEPA. At that time, ADOT verified through Region 9 NPDES Administrator, Eugene Bromley, that ADOT should await approval prior to implementing the monitoring plan. The storm water monitoring plan was revised and resubmitted to USEPA in February 2002, however ADOT received no comments.

On December 5, 2002, the Arizona Department of Environmental Quality (ADEQ) obtained primacy for the NPDES program from USEPA. ADOT resubmitted the revised monitoring plan to ADEQ for approval and has been informed by ADEQ that ADOT should await approval prior to implementing the monitoring plan. In March of 2003, ADOT submitted a Phase II, small MS4 application to ADEQ (*AZPDES Phase II Permit Application, Proposed Modification of Existing Phase I Permit, MS4 Permit #AZS000018*, March 2003.). Within the application, ADOT requested that the individual Phase I permit #AZS000018 be modified to include the Phase II MS4 requirements. The ADOT Phase II MS4 program will eventually be integrated into the Phase I MS4 program via a new individual permit issued by ADEQ. This storm water monitoring plan has been revised to integrate Phase I and Phase II monitoring and will be resubmitted to ADEQ for approval.

The primary objective of ADOT's storm water monitoring plan is to assess the effectiveness of its storm water pollution prevention program. A key part of the program assessment is also the evaluation of Best Management Practices (BMPs) as detailed in the annual report. ADOT will maintain a comprehensive approach to storm water monitoring that will consist of three elements; 1) BMP performance evaluation, 2) dry weather field screening, and 3) water quality impact assessment.

2.0 ROADWAY RUNOFF CHARACTERIZATION SITES

ADOT will conduct storm water monitoring to assess water quality impacts and trends associated with highway runoff. Data acquired from this monitoring effort will assist in evaluating BMP performance and allow for adjustments to be made to the storm water monitoring program.

ADOT initially proposed the use of automatic samplers in the monitoring plan submitted to USEPA in September 2000. However, recent information provided to ADOT indicates that automatic samplers are unreliable and impractical in the arid climate in Arizona. Therefore, ADOT will utilize manual collection of storm water samples for laboratory analysis.

2.1 Monitoring Site Locations

Criteria for selecting roadway runoff characterization monitoring sites were developed by ADOT based on the goal of collecting samples that provide data representative of roadway runoff in Maricopa and Pima counties. Monitoring sites were chosen based on two criteria: daily traffic volume and contributing drainage area.

Daily Traffic Volume

Roadway monitoring sites were selected due to a wide range of daily traffic volumes. Vehicles traveling on the roadways are the most significant pollutant source for storm water generated on ADOT roadways. The monitoring of storm water at locations with a wide range of traffic volume will provide a comparison of the concentration of various parameters to the number of cars traveling on the roadways. The ranges of average daily traffic counts on all ADOT roadways in the Phoenix and Tucson metropolitan areas in 1999 were 47,000 to 264,000 and 24,400 to 134,300, respectively, (Maricopa Association of Governments 1999; Pima Association of Governments 1999).

Contributing Drainage Area

In many areas, storm water collected from ADOT roadways is co-mingled with drainage from adjacent areas, primarily local municipalities. When this is the case, it is difficult to distinguish which pollutants originate from the roadways and which pollutants originate from other sources. The two monitoring sites were selected because the storm water runoff from these sites is not co-mingled with storm water from any other area. Therefore, data from these monitoring sites will allow for a more accurate characterization of storm water discharged exclusively from ADOT roadways.

ADOT has selected one roadway runoff characterization monitoring site each in Phoenix and Tucson for storm water monitoring but will remain flexible within this monitoring plan to use alternative monitoring sites if issues arise regarding safety of sampling personnel, storm water drainage patterns, monitoring site inaccessibility, etc. Additional monitoring sites may be

selected if additional data is necessary. Any change to the monitoring sites will be documented in ADOT's annual report of the Storm Water Management Plan, which is submitted to ADEQ.

Phoenix Metropolitan Area

The monitoring site in Phoenix is located along LOOP 202 just east of 32nd Street on the north side of the roadway (see Figure 1 in Appendix A). This monitoring site collects storm water from a portion of Loop 202, which averages 190,000 vehicles per day (Maricopa Association of Governments 1999).

The Phoenix monitoring site is accessible for manual storm water sampling. The site is generally secure since it is inconspicuous and is surrounded by fencing. The monitoring site serves a drainage area of 3.7 acres from which storm water is discharged to a retention basin.

Tucson Metropolitan Area

The monitoring site in Tucson is located along I-10 just north of Grant Road on the west side of the roadway (see Figure 2 in Appendix A). This portion of I-10 averages a daily traffic volume of 115,900 vehicles per day (Pima Association of Governments 1999).

The Tucson monitoring is accessible for manual storm water sampling. The site is generally secure since it is within the main ADOT maintenance yard in Tucson. The maintenance yard is surrounded by a fence and has a locked gate. The monitoring site serves a drainage area of 4.8 acres from which storm water is discharged through a culvert that drains to the Santa Cruz River.

2.2 Monitoring Parameters

Specific criteria were developed by ADOT to determine the list of parameters to be analyzed for ADOT storm water monitoring: sources of contaminants and limitations of sampling.

Sources of Contaminants

Fossil fuel combustion, wear of tires, brake pads, bearings, bushings, and other moving parts in vehicles, leaking lubricants and hydraulic fluids, and roadway deicing are sources that may contribute to pollutants entering storm water from roadways. These potential pollutant sources were considered in the selection of monitoring parameters.

Limitations of Sampling

The collection of storm water samples from ADOT roadways places some limitations on the selection of parameters. Arizona rainfall can be unpredictable and of short duration and not all rainfall events produce storm water runoff. The amount of storm water runoff from roadways can be variable. Due to the climatic conditions of Arizona and the small contributing drainage areas along roadways, only manual samples will be collected.

The water quality parameters contained in Table 1 will be analyzed for samples collected at each roadway runoff characterization site in Phoenix and Tucson.

Table 1. Parameter List for Roadway Runoff Characterization

Parameter Group	Parameters
Field Calculation:	• Discharge (estimated in standard cubic feet per minute)
Conventionals:	• Biochemical oxygen demand (BOD_5) • Chemical oxygen demand (COD) • Hardness • pH • Water temperature • Specific conductance • Total dissolved solids (TDS) • Total suspended solids (TSS)
Nutrients:	• Nitrate ($NO_3 – N$) • Nitrite ($NO_2 – N$) • Total kjeldahl nitrogen (TKN) • Total phosphorous
Metals: (total recoverable and dissolved)	• Cadmium • Chromium • Copper • Lead • Zinc
Organics:	• Total petroleum hydrocarbons (TPH) • Total phenols • DDE

Arizona rainfall can be unpredictable and of short duration, therefore, all rainfall events may not produce a storm water discharge. The amount of storm water discharge at a monitoring site can be variable. If the sample volume is insufficient to perform all the analyses indicated above, the following priority shall be used to determine the contaminant groups that will be analyzed. Given that automobiles traveling on the roadways are the most significant source of pollutants that could potentially enter storm water, total petroleum hydrocarbons and metals were selected to have the highest priority for analysis followed by BOD_5, COD, TDS, and TSS. The prioritized parameters are listed below with the associated volumes required for analysis:

1. Total Petroleum Hydrocarbons (1 liter)
2. Total recoverable metals (1 liter)
3. Dissolved metals (1 liter)
4. BOD_5, COD, TDS, TSS (2.5 liters)

Information such as sample collection date and time, observations, and discharge measurements will be recorded in a field logbook.

2.3 Sample Collection Time Frames

ADOT will conduct monitoring at the roadway runoff characterization sites twice a year during the time of year when there is increased rainfall. The majority of rainfall occurs late in the summer and during the winter months for both Phoenix and Tucson. Therefore, monitoring will be conducted from July 1st through September 30th and from December 1st through February 28th. Samples will be collected at each monitoring site:

- During the first 30 minutes of a storm water discharge whenever possible (or as soon thereafter as practicable) to capture the "first flush" of pollutants;
- After the first 30 minutes of a storm water discharge if the duration of the discharge is sufficient in length to collect flow-weighted composite samples;
- During daylight hours;
- Any day of the week;

2.4 Sample Collection Methods

For the purpose of monitoring, a storm event is defined as a rainfall amount of at least 0.1" in precipitation. During storm water monitoring events, sample collection procedures are followed to ensure that sample collection proceeds in a careful and consistent manner.

Phoenix Metropolitan Area

A *Field Sampling Protocol* was developed by the Flood Control District of Maricopa County and will be used to guide monitoring personnel. This document provides all information needed for an individual to manually collect storm water samples.

Tucson Metropolitan Area

A *Stormwater Sampling Guide* was developed by the City of Tucson and will be used to guide monitoring personnel. This document provides all information needed for an individual to set up, maintain, and manually collect samples from storm water quality sampling stations.

Storm water samples will be collected manually using one or both of the following two procedures (refer to section 6.1 for detailed information on sample collection protocols):

- MANUAL GRAB SAMPLE - An individual sample of at least 100 milliliters collected during the first thirty minutes (or as soon thereafter as practicable) of the storm water discharge. The first 30 minutes of a storm water discharge is referred to as the "first flush" and typically contains the highest concentration of roadway pollutants.

- FLOW-WEIGHTED COMPOSITE SAMPLE – May be collected after the manual grab samples have been collected if the storm water discharge persists. This sample is composed of continuous samples or several manual grab samples combined in a flow proportional manner for the entire storm event or for the first three hours of the storm event – whichever is longer.

It is the monitoring personnel's discretion to determine which type of sample is collected. Factors that may influence the decision are storm event duration, laboratory arrangements, personnel availability and safety.

3.0 DRY WEATHER FIELD SCREENING SITES

Dry weather field screening will result in several outfalls being investigated or "screened" on an annual basis to identify illicit connections and illegal dumping activity.

3.1 Monitoring Site Locations

An inventory of ADOT storm water management structures, outfalls, and facilities within the large and small MS4s has been completed. Each inventoried storm water management structure, outfall, and facility is on a 5-year inspection cycle. Those storm water outfalls that exhibit dry weather flows will be investigated and sampled.

Should an outfall develop a dry weather flow that was not observed on a previous inspection, it will be investigated and sampled within 15 days of discovery.

Large MS4s

ADOT has inventoried and identified 46 major storm water outfalls in the Phoenix area and 14 major storm water outfalls in the Tucson area. Of these 60 major outfalls, only 7 currently have dry weather flows. These 7 major outfalls with dry weather flows are located in the Phoenix area. They are as follows:

Outfall	Receiving Water	Route No.	Location	Latitude Longitude
101-51.07	Salt River	Loop 101	S. bank; east of 101 under 202 interchange	33º 26’ 16” N 111º 53’ 26” W
10-130.3	Agua Fria River	I-10	½ mi. W. of El Mirage Rd. & 100’ N. of I-10	33º 27’ 33” N 112º 19’ 49” W
10-145.17	Salt River	I-10	N. bank; west side of Central Ave.	33º 25’ 24” N 112º 4’ 25” W
101-7.76	New River	Loop 101	¼ mi. S. of Northern Ave. & 1000’ W. of 99th Ave.	33º 32’ 55” N 112º 16’ 34” W
10-149.18	Salt River	I-10	N. bank; east side of 20th St.	33º 25’ 3” N 112º 2’ 21” W
153-1.64	Salt River	SR 153	S. bank; west of expressway	33º 25’ 47” N 111º 58’ 53” W
202-3.57	Salt River	Loop 202	Directly under Loop 202/SR143 interchange	33º 27’ 29” N 111º 58’ 57” W

Small MS4s

An inventory of ADOT storm water management structures, outfalls, and facilities within the small MS4s has recently been completed. It is anticipated that, upon inspection, all outfalls within the small MS4s that have dry weather flows will be investigated and sampled.

3.2 Monitoring Parameters

Samples collected at dry weather field screening sites are analyzed on site utilizing field test kits. Samples will be analyzed for the water quality parameters contained in Table 2.

Table 2. Parameter List for Dry Weather Field Screening Field Tests

Parameter Group	Parameters
Field Calculation:	• Discharge (estimated in standard cubic feet per minute)
Conventionals:	• pH • Turbidity • Color • Total chlorine • Water temperature • Air temperature
Nutrients:	• Ammonia
Metals:	• Total recoverable copper
Organics:	• Total phenols • Surfactants (detergents)

When used as directed, field test kits provide results that are generally acceptable for characterizing the water quality of dry weather flows without waiting for several weeks on laboratory analyses. However, there may be times when it is necessary to verify the field test results by collecting and submitting samples to an analytical laboratory. There may also be times when it is necessary to expand upon the parameter list in Table 2 to further characterize water quality conditions and determine the potential source of the dry weather flows.

In addition to field test results and laboratory analyses, in most situations, visual observations will allow quick assessments to be made on sites needing further investigation. Information collected in the field will be recorded on a Dry Weather Field Screen Site Report form (Appendix C).

3.3 Sample Collection Time Frames

Under NPDES permit #AZS000018, ADOT is required to inspect a minimum of 20% of the outfalls each year. Therefore, each inventoried storm water outfall is on a 5-year inspection cycle.

When an outfall has dry weather flow, two grab samples are collected within a 24-hour period with a minimum period of four hours between samples (40 CFR 122.26).

3.4 Sample Collection Method

Water sample bottles for the field test kits will be filled while facing upstream to minimize any streambed disturbance that could influence water quality. Dry weather field screening samples that will be analyzed by a laboratory will be collected manually using the following procedure (refer to section 6.1 for detailed information on sample collection protocols):

- MANUAL GRAB SAMPLE - An individual sample of at least 100 milliliters collected from the dry weather discharge.

4.0 SENSITIVE RECEIVING WATER SITES

Under the Phase II MS4 requirements, ADEQ is requiring monitoring for outfalls within the small MS4s that discharge into impaired and not-attaining waters (Permit No. AZG2002-002, *Arizona Pollutant Discharge Elimination System General Permit for Discharge from Small Municipal Separate Storm Sewer Systems (MS4s) to Waters of the U.S.*).

See ADEQ's 303(d) list for a list of current impaired and not-attaining waters at *http://www.azdeq.gov/environ/water/assessment/assess.html*.

4.1 Monitoring Site Locations

An inventory of ADOT storm water management structures, outfalls, and facilities within the small MS4s has recently been completed. It is anticipated that outfalls into impaired and not-attaining waters will be monitored only if the MS4 discharge may contain the pollutants of concern.

4.2 Monitoring Parameters

The purpose of monitoring will be to detect the presence of one or more pollutants that may be present in storm water runoff that could contribute to water quality impairment of the surface receiving water. Information such as sample collection date and time, field measurements, observations, and discharge measurements will be recorded in a field logbook.

4.3 Sample Collection Time Frames

ADOT will conduct sensitive receiving water monitoring twice a year during the time of year when there is increased rainfall. The majority of rainfall occurs late in the summer and during the winter months for most of Arizona. Therefore, ADOT will conduct monitoring from July 1st through September 30th and from December 1st through February 28th of each calendar year.

4.4 Sample Collection Method

Sensitive receiving water samples will be collected manually utilizing the following procedure (refer to section 6.1 for detailed information on sample collection protocols):

- MANUAL GRAB SAMPLE - An individual sample of at least 100 milliliters collected from the dry weather discharge.

5.0 ANALYTICAL METHODS

5.1 Laboratory Selection and Contracting

Important considerations when selecting an analytical laboratory include location, performance, ability to meet analytical reporting limits (RLs), also known as practical quantification limits (PQLs), and experience with the types of samples that will be collected by ADOT.

Arizona Department of Health Services (ADHS) certification is required for laboratories analyzing ADOT monitoring samples. In certain cases, it may be difficult to contract for all required analyses with ADHS-certified laboratories. In such cases, alternative arrangements may be made provided that the exception is documented and approved by the ADOT task order manager. For example, if parameter RLs cannot be adequately achieved by certified laboratories, a research level laboratory with a proven ability to perform the needed analysis can be used with approval from the ADOT task order manager. Such laboratories may include out-of-state commercial laboratories or university/research laboratories with demonstrated expertise in USEPA-sponsored research or method development programs

5.2 Analytical Methods

Sample analyses will be conducted according to the test procedures approved within 40 CFR 136. For some parameters, alternative analytical methodologies may be used to meet the data quality objectives for RLs and quality control limits. Also, methods are constantly being updated and new methods may be developed for different analytical parameters. In selecting the analytical method to be used, the following questions should be addressed:

- Does the method conform to any legal or regulatory requirements for the monitoring program?
- Does the method allow the required reporting limits to be easily obtained on storm water samples?
- Does the method have the same or more stringent quality control limits than a comparable method?
- Will the data provided by the method be comparable to historical data collected at the monitoring site?
- Is the method recognized as “standard” so that the data collected at a monitoring site can be compared to other monitoring sites?
- Is the laboratory proficient with the method? Do they have historical data to show proficiency?

The recommended analytical methods for conventional, nutrient, metal, and organic parameters are shown in Table 3. All of these methods are described either in *Standard Methods for the Examination of Water and Wastewater, 20th Edition* or in the listed USEPA method. The listed methods may be consulted for more detailed analytical information.

5.3 Reporting Limit Requirements

Table 3 lists the RLs for the list of analytical parameters to be monitored. The reporting limit is the minimum level to which the analytical laboratory reports data for a specific test method or sample. This operational definition relies on the laboratory's historical practice of reporting and a thorough review of laboratory practice and performance. The RLs in Table 3 are provided as a guide for monitoring that does not have historical data sets for reference.

It is important to ensure that the RLs derived for the project are low enough to provide useful results. The selected analytical methods should provide RLs at or below the criteria against which the storm water samples are to be compared. For example, if the analytical results are to be compared with Arizona surface water quality standards (A.A.C. R18-11), every effort should be made to ensure that the RLs are lower than the standards.

5.4 Laboratory Data Package Deliverables

As a part of the laboratory contract, the data package that will be delivered to ADOT and the timing of its delivery (turn around time) should be defined. Common turn around times for laboratory data packages are two to three weeks for faxed data and three weeks to thirty days for hard copy and electronic copy. Receiving the faxed data quickly allows an early data review to identify any problems that may be corrected through re-extraction or re-analysis of leftover sample that is still at the laboratory (unless notified to do otherwise, the laboratory only keeps leftover samples for 30 days). The data package should be delivered in hard copy and electronic copy (on diskette).

The hard copy data package should include a narrative that outlines any problems, corrections, anomalies, and conclusions, as well as completed chain of custody documentation. A summary of the following quality assurance/quality control (QA/QC) elements must be in the data package (see Tables 4 and 5 in Section 7 of this manual):

- Sample extraction and analysis dates
- Results of method blanks
- Summary of analytical accuracy (matrix spike and duplicate compound recoveries and lab control samples)
- Summary of analytical precision (comparison of laboratory control samples, matrix duplicate and matrix spike duplicate results)
- Summary of organic method performance (surrogate spike compound recoveries)
- Reporting limits

Table 3. Laboratory Analytical Parameter Method Specifications

Parameter	Method No.	Holding Time	Container Type	Container Volume	Preservation	Reporting Limit	Units
Conventionals							
BOD_5	EPA 405.1/SM 5210B	48 hours	Plastic	I Liter	4°C	3	mg/L
COD	EPA 410.1/SM 5220D	28 days	Plastic	500 ml	4°C and H2SO4 to pH<2	10	mg/L
Hardness	EPA 200.7/SM 2340B	6 months	Plastic	I Liter	HNO3 to pH<2	2	mg/L
PH	EPA 150.1	Analyze immediately	Plastic	I Liter	None	0.1	std. units
Water Temperature	EPA 170.1/SM 2550B	Analyze immediately	Plastic	1 Liter	None	0.1	EC
Specific Conductance	EPA 120.1/SM 2510B	28 days	Plastic	I Liter	4°C	2	µmhos/cm
TDS	EPA 160.1/SM 2540C	7 days	Plastic	I Liter	4°C	1	mg/L
TSS	EPA 160.2	7 days	Plastic	I Liter	4°C	1	mg/L
Turbidity	EPA 180.1/SM 2130B	48 hours	Plastic	I Liter	4°C	0.1	NTU
Color	EPA 110.2/SM 2120	48 hours	Plastic	I Liter	4°C	1	units
Nutrients							
Nitrate (NO3-N)	EPA 300.0/SM 4500	48 hours	Plastic	500 ml	4°C	10	mg/L
Nitrite (NO2-N)	EPA 300.0/SM 4500	48 hours	Plastic	500 ml	4°C	0.1	mg/L
Total Phosphorous	EPA 365.1/SM 4500	28 days	Plastic	500 ml	4°C and H2SO4 to pH<2	0.03	mg/L
Total Kjeldahl Nitrogen (TKN)	EPA 351.4	28 days	Plastic	500 ml	4°C and H2SO4 to pH<2	0.1	mg/L
Ammonia	EPA 350.1/EPA 350.3	28 days	Plastic	500 ml	4°C and H2SO4 to pH<2	0.03	mg/L
Metals							
Cadmium	EPA 200.8	6 months	Plastic	I Liter	4°C and HNO3 to pH<2 Filter the dissolved samples before adding HNO3; Preserve dissolved samples within 48 hours of collection	5	µg/L
Chromium						10	µg/L
Copper						10	µg/L
Lead						30	µg/L
Zinc						10	µg/L
Organics							
TPH	EPA 418.1W	14 days	Amber glass	I Liter	4°C and 1:1 H2SO4	1	mg/L
Total Phenols	EPA 420.1	28 days	Amber glass	I Liter	4°C and H2SO4 to pH<2	0.1	mg/L
DDE	EPA 608	7 days to extraction; 40 days to analysis	Amber glass	2 - 1 Liter	4°C and Na2S2O3 if chlorinated to pH 5-9	0.01	µg/L
Surfactants (detergents)	EPA/425.1/SM 5540	48 hours	Plastic	1 Liter	4°C	0.02	mg/L

6.0 SAMPLE COLLECTION, TREATMENT, AND HANDLING

To minimize the chance of sample contamination and unreliable analytical results, special measures must be taken during the collection, treatment, and handling of samples prior to analysis. For example, samples must be collected properly, stored in the appropriate containers, and preserved immediately. In addition, some analytical methods require filtration of the sample prior to analysis. Samples must be analyzed within established holding times to ensure reliability of the results. Chain-of-custody procedures must be followed for sample handling and transportation to the laboratory. Each of these measures is discussed in more detail below.

6.1 Sample Collection Protocols

Water quality sampling shall employ "clean" sampling techniques to minimize potential sources of sample contamination – particularly from trace pollutants. Experience has shown that when clean sampling techniques are used, detected concentrations of constituents tend to be lower. Clean sample collection techniques that should be followed during the collection of water samples are described below. Care must be taken during sampling to minimize exposure of the samples to human, atmospheric, and other potential sources of contamination. Care must also be taken to avoid contamination whenever handling containers and lids. To reduce potential contamination, monitoring personnel must adhere to the following rules while collecting water samples:

- Do not eat, drink, or smoke during sample collection.
- Never sample near a running vehicle.
- Do not park vehicles in immediate sample collection area (even non-running vehicles).
- Always wear clean, powder-free nitrile gloves when handling sample containers and lids.
- Never touch the inside surface of a sample container or lid, even with gloved hands.
- Never allow the inner surface of a sample container or lid to be contacted by any material other than the sample water.
- Do not overfill sample containers (preservative may be lost).
- Never allow any object or material to fall into or contact the collected sample water.
- Avoid allowing rainwater to drip from rain gear or other surfaces into sample containers.
- Replace and tighten sample container lids immediately after sample collection.

Sampling sites should be approached from downstream whenever possible to minimize any streambed disturbance that could influence water quality. Be careful that the flow is not concentrated to the point the channel starts to erode and increases the amount of sediment in the water. Samples will be collected while facing upstream. When filling a sample bottle, lower the bottle slowly into the water to avoid hitting the streambed, disturbing the bottom, and stirring up sediment.

Storm water samples will be collected manually using either the manual grab sample technique or the flow-weighted composite sample technique.

Manual Grab Sample Technique

A manual grab sample will define water quality at a distinct point in time. These samples are easily collected and are favored when the anticipated water quality of the discharge is homogeneous, or unchanging, in nature.

A manual grab sample is an individual sample of at least 100 milliliters usually collected by direct submersion of each individual sample bottle into the water to be sampled. To collect samples, the water depth will need to be at least 1 centimeter or 0.5 inch. Filling a sample bottle is difficult when the water is shallow and the bottles cannot be completely submerged. Thus, an intermediate container should be used. For example, one clean, unpreserved sample bottle can be designated as the intermediate container and used to collect multiple grab samples to fill the remaining sample bottles. Fill the bottles as full as possible without overfilling.

The manual grab sample is collected separately from the flow-weighted composite samples and is analyzed separately from the flow-weighted composite samples as they yield different results.

Flow-Weighted Composite Sample Technique

A flow-weighted composite sample will define representative water quality over a measured period of time. These samples are favored when the anticipated water quality of the discharge is heterogeneous, or fluctuating, in nature.

A flow-weighted composite sample is a composition of manual grab samples, or sample aliquots, that are evenly distributed among all of the sample bottles. A minimum of three sample aliquots are taken in each hour of discharge over the entire storm event (or for the first three hours of the event). Each sample aliquot must be at least 100 milliliters. Each sample aliquot is collected with a minimum period of fifteen minutes between aliquot collections.

6.2 Sample Preservation

Chemical preservatives are added to the samples for certain analyses to prolong the stability of the parameters during transport and storage. Table 3 lists the required sample preservatives for the analytical parameters. If composite sampling procedures are used, no preservatives are added to the composite container because no single chemical preservative is suitable for all of the parameters to be analyzed. The laboratory must first divide the composite sample into the appropriate bottle for each analysis, and then add chemical preservatives as appropriate for each analysis. If manual grab sampling procedures are used (i.e., monitoring personnel directly fill the containers required for each analysis), the monitoring personnel should add the appropriate preservative to each sample container immediately. All samples will be iced immediately after collection.

6.3 Sample Filtration

Sample filtration is required when collecting samples for dissolved metals determinations. It is recommended that filtration for metals be conducted by the analytical laboratory to reduce the potential for contamination in the field, especially during storm conditions. USEPA specifies the use of a 0.45 mm, 15 mm diameter or larger, tortuous-path capsule filter or equivalent. To minimize dissolved/suspended phase partitioning of metals from the time of sample collection to the time of analysis, it is essential that the laboratory perform the sample filtration promptly upon receipt. The monitoring personnel should therefore specify "filter for dissolved metals and preserve immediately upon receipt" on the sample chain-of-custody form, and coordinate this activity with the laboratory in advance.

6.4 Holding Times

Maximum acceptable holding times are specified for each analytical method in Table 3. The holding time starts when sample collection is complete and is counted until extraction/preparation or analysis of the sample at the laboratory. If a sample is not analyzed within the designated holding time, the analytical results may be suspect. Thus, it is important that the monitoring personnel meet all specified holding times and the laboratory make every effort to prepare and analyze the samples as soon as possible after they are received. Prompt analysis also allows the laboratory time to review the data and, if analytical problems are found, re-analyze the affected samples.

Some holding times are short and will require the laboratory to analyze the sample promptly after receipt. For example, BOD_5 analyses must be performed within 48 hours after sample collection. Holding times may be a factor affecting allowable sampling times if the laboratory has not agreed to work evenings or weekends. To minimize the risk of exceeding the holding times, storm water samples must be transferred to the analytical laboratory as soon as possible after sampling is complete. Moreover, the laboratory should be notified before the sampling begins so that it can prepare to analyze the samples immediately upon receipt.

The time of collection of the final sample aliquot is considered the "sample collection time" for determining sample holding time for flow-weighted composite samples.

6.5 Chain of Custody

Chain-of-custody (COC) forms are provided by the laboratory (see blank COC form in Appendix B). They are to be filled out by monitoring personnel for all samples submitted to the analytical laboratory. The purpose of COC forms is to keep a record of the sample submittal information and to document the transfer of sample custody. Sample date, sample location, and analyses requested are noted on the COC form. Any special instructions for the laboratory should also be noted on the COC form such as specifications of quality control requirements (e.g., duplicate samples). The COC form must be signed by both the person relinquishing the samples and the

person receiving the samples every time the samples change hands, thus documenting the chain of custody. No sample ever leaves the possession of any ADOT employee until it is relinquished to the laboratory. No third party will be used to collect, prepare, or deliver samples without the presence of an ADOT employee.

Custody seals are used to detect unauthorized tampering with the samples. The seals are printed on strips of adhesive-backed paper. They are affixed over the lid of a filled sample bottle in such a way that the sample bottle cannot be opened without breaking the seal. Custody seals must be completed and affixed to all sample bottles before the samples leave the custody of the monitoring personnel. Custody seals may also be used on each cooler.

7.0 QUALITY ASSURANCE/QUALITY CONTROL

The QA/QC program ensures that the samples collected are of the highest quality and that the laboratory analyzing the samples is producing reliable results. The same QA/QC procedures will be followed for the all ADOT monitoring sites.

7.1 Field QA/QC Procedures

Field QA/QC procedures include aspects of preparedness and field QC samples.

Preparedness

Sampling equipment, sample bottles, and forms are readied for each monitoring site prior to a monitoring event to ensure that the necessary equipment is ready and available. By preparing for an event ahead of time, the possibility of filling incorrect bottles or mislabeled bottles can be avoided. All equipment is readied for the next monitoring event upon return from the previous monitoring event.

Field QC Samples

Two types of field QC samples are collected: duplicates and splits.

- DUPLICATES - Samples are taken as a single sample and split into two separate, but identical samples. Both samples are sent to the same laboratory; one of the sample's identity is disguised to keep the lab from knowingly making the results match. The collection frequency of this sample is 10% or one in ten samples. The two samples' results are compared to determine the sample duplicate precision, which is a measure of laboratory precision and accuracy. Sample duplicate precision is calculated with the following formula and is expressed as relative percent difference (RPD):

  Sample Duplicate Precision (RPD) = ((duplicateA – duplicateB) / duplicateA) x 100

- SPLITS - Samples are taken as a single sample and split into two separate, but identical samples. The samples are labeled identically but are sent to different laboratories. The frequency of this sample will be once per year. The two samples' results are compared to determine sample duplicate precision, which is a measure of laboratory precision and accuracy. Sample duplicate precision is calculated with the following formula and is expressed as relative percent difference (RPD):

  Sample Duplicate Precision (RPD) = ((splitA – splitB) / splitA) x 100

Table 4 lists the acceptable limits for sample duplicate precision.

Table 4. Acceptable Limits for Sample Duplicate Precision

Parameter	Sample Duplicate Precision
BOD_5	<30% RPD
COD	<30% RPD
Hardness	<15% RPD
PH	<15% RPD
Temperature	<15% RPD
Specific Conductance	<15% RPD
TDS	<15% RPD
TSS	<15% RPD
Turbidity	<15% RPD
Color	<15% RPD
Nutrients	<15% RPD
All Metals	<35% RPD
TPH	<50% RPD
Total Phenols	<35% RPD
DDE	<50% RPD
Surfactants	<35% RPD

7.2 Laboratory Quality Assurance Plan

In order to be certified by ADHS, an analytical laboratory is required to have a Quality Assurance Plan (QAP) or Quality Assurance Manual that contains a set of QA/QC procedures that cover all aspects of laboratory operations. The contracted laboratory will provide a copy of its QAP upon request.

7.3 Analytical Quality Control Requirements

Table 5 lists the minimum laboratory quality control requirements required for ADOT monitoring:

7.4 Cleanliness

Cleanliness of the sampling equipment is vital to ensuring that contamination is not introduced from a controllable factor. Sample bottles must be certified clean by the laboratory to minimize sample contamination. Clean techniques must be used when handling and splitting the composite sample and when performing sample filtration.

Table 5. Minimum Laboratory QC Requirements

Sample Type	Frequency	Purpose
Method Blank	5% of instrument batch*	Check for contamination
Matrix Spike	5% of instrument batch	Measure accuracy
Matrix Duplicate	5% of instrument batch	Monitor precision and reproducibility
Matrix Spike Duplicate	5% of instrument batch	Measure accuracy & precision
Surrogate Spike	Every QC & analytical sample	Measures organic method performance
Lab Control Sample	5% of instrument batch	Measure method accuracy
Lab Control Duplicate Sample	5% of instrument batch	Measure method accuracy & precision
Proficiency Samples	Annually	Prove proficiency w/in study area
Double Blind Samples	Annually	Assess laboratory operations

* Instrument batch here is defined as a set of 10 analytical samples run in succession

7.5 Sample Collection

The quality of monitoring data is highly dependent upon the ways in which the data is collected and handled by monitoring personnel. One way to ensure data quality is to limit the responsibility for conducting monitoring to one or two trained persons. If this cannot be accomplished, and several people will be participating in the monitoring, then, at a minimum, everyone who may be participating is required to receive appropriate training in the proper sample collection procedures.

7.6 Field Records

Field records must be kept to record all activities at each monitoring site. Information such as sample collection date and time, field measurements, observations, and discharge measurements are recorded in the field records. Field records are summarized as follows:

- Roadway Runoff Characterization – Field records are recorded in a field logbook.
- Dry Weather Field Screening - Appendix C contains a blank Dry Weather Field Screen Site Report form for field records.
- Sensitive Receiving Waters - Field records are recorded in a field logbook.

7.7 Data Review and Validation

Data review and validation uses all of the sampling data received for an event. All reports from the contract laboratory are reviewed upon receipt. Checks of the holding times, proper chain of custody procedures, preservation, sample data, QC sample data, and lab QC data are made to determine the validity of the data. Data review and validation will be completed by a contractor and submitted to ADOT. A Data Validation Sheet (Appendix D) is completed and attached to

each data set. Any circumstance in which the data do not meet the criteria on the review sheet, or data that seem questionable, must be reported to the laboratory for resolution.

8.0 DATA MANAGEMENT

Storm water sampling data may be stored in electronic and/or paper files. The data files will be readily accessible for review, assessment, and reporting purposes. To facilitate data management, analysis, and the comparison of results, ADOT has developed a standard system for managing storm water information. To keep sampling data organized, all data must be clearly labeled with the sampling site information.

8.1 Data Types

There are two primary types of data collected in the storm water monitoring program: field records and laboratory water quality data.

Field Records

Field records contain field measurement results and physical observations that are recorded during a sampling event. The format used for field records varies somewhat, depending upon the type of site, and are summarized below:

- Roadway Runoff Characterization Sites – Field records are recorded in a field logbook.
- Dry Weather Field Screening Sites – A Dry Weather Field Screen Site Report form is used for field records (Appendix C contains a blank form).
- Sensitive Receiving Water Sites - Field records are recorded in a field logbook.

Field records include information such as:

- Field logbooks
- Dry Weather Field Screen Site Reports
- Chain-of-custody forms

Laboratory Water Quality Data

The laboratory water quality data is a direct result of the samples collected during a sampling event. Samples are analyzed by an analytical laboratory for the pollutants listed in Table 3. The laboratory reports data in both a paper report and in an electronic format. In addition to sample results, the laboratory may also include detailed information on internal laboratory quality assurance and quality control.

Laboratory water quality data include information such as:

- Laboratory reports
- Quality assurance reports
- Data validation sheets

8.2 Data Retrieval and Storage

Field records and analytical water quality data are managed electronically in ADOT's Storm Water Information Management System (SWIMS), which has been created within ADOT's Information Technology system. SWIMS is continually updated as information is collected.

8.3 Reporting Requirements

ADOT is required to document all storm water monitoring and submit the findings to ADEQ in accordance with NPDES permit #AZS000018. Discharge Monitoring Reports (DMRs) are submitted to ADEQ on a monthly basis even if there has not been a monitored event during the month. A separate DMR is completed for each monitoring site that has been identified in the monitoring plan.

DMRs shall be submitted to ADEQ at the following address:

Arizona Department of Environmental Quality
Compliance Data Unit
1110 W. Washington
Phoenix, AZ 85007

Appendix E contains a blank DMR form that may be photocopied.

ADOT shall report to ADEQ any noncompliance, which may endanger human health or the environment. ADOT shall orally notify the office listed below within 24 hours:

Arizona Department of Environmental Quality
1110 W. Washington, 5th floor (5555)
Phoenix, AZ 85007
Office: 602-771-4841; Fax 602-771-4505

A written submission shall also be provided to the office identified above within five days of the time ADOT becomes aware of the circumstances. The written submission shall contain a description of the noncompliance and its cause; the period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance.

ADOT will also provide ADEQ with a Storm Water Management Plan Annual Report, which is due September 30 of each permitted year.

8.4 Records Retention

ADOT shall retain copies of all sampling data and DMRs for a period of three years from the date of the samples. ADEQ may extend the retention period at any time.

9.0 REFERENCES

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Maricopa Association of Governments, 1999. *Regional Transportation Plan.* Phoenix, Arizona.

Pima Association of Governments, 1999. *Regional Transportation Plan.* Tucson, Arizona.

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U.S. Environmental Protection Agency, 2000. *Storm Water Discharges: U.S. Code of Federal Regulations, Title 40, Chapter 1, §122.26*. Washington, D.C.

10.0 GLOSSARY

303(d) List – The 303(d) list is a list of water bodies that have a beneficial use that is impaired by one or more pollutants. The 303(d) list is required by Section 303(d) of the federal CWA. Water bodies included on this list are referred to as "impaired waters." The state must take appropriate action to improve impaired water bodies by establishing TMDLs and reducing/eliminating pollutant discharges.
ADEQ – Arizona Department of Environmental Quality
ADHS – Arizona Department of Health Services
ADOT – Arizona Department of Transportation
Aliquot –
AZPDES – Arizona Pollutant Discharge Elimination System
BMPs – Best Management Practices. A permit condition used in place of or in conjunction with effluent limitations to prevent or control the discharge of pollutants and may include a schedule of activities, the prohibition of specific practices, maintenance procedures, or other management practice. BMPs may also include treatment requirements, operating procedures, or practices to control plant site runoff, spillage, leaks, sludge or waste disposal, or drainage from raw material storage.
BOD_5 – Biochemical oxygen demand
COC – Chain of custody
COD – Chemical oxygen demand
Contractor – Party responsible for carrying out the contract per plans and specifications.
Designated uses – Those water uses identified in state water quality standards that must be achieved and maintained as required under the Clean Water Act. Uses can include cold water fisheries, public water supply, and irrigation.
Discharge – Any release, spill, leak, pump, flow, escape, dumping, or disposal of any liquid, semisolid or solid substance. Also means any addition of any pollutant to waters of the United States from any point source (A.R.S. 49-255(2).
DMR – Discharge Monitoring Report
Downstream – In the direction of the current of a stream.
Ephemeral flow – Surface water that has a channel that is at all times above the water table, that flows only in direct response to precipitation, and that does not support a self-sustaining fish population (Arizona Administrative Code R18-11-101).
Holding time – The maximum amount of time a sample may be stored before analysis.
Impaired water – A navigable water for which credible scientific data exists that satisfies the requirements of section 49-232 and that demonstrates that the water should be identified pursuant to 33 United States Code section 1313(d) and the regulations implementing that statute.
Intermittent flow – Surface water flows only at certain times of the year when receiving water from springs or from some surface source such as melting snow in mountainous areas (i.e., seasonal).
L – Liter; equal to 1000 milliliters.
mg – Milligram; equal to 0.001 gram.
Mg/L – Milligram per liter; roughly equivalent to a part per million.
ml – Milliliter; equal to 0.001 liter.

Monitoring – Refers to a variety of activities and processes through which ADOT will obtain information relevant to its implementation of the storm water quality management program so that the need for and/or opportunities for revising or refining its program can be identified.
Nonpoint source – These sources of pollutants come from nondiscrete discharges such as atmospheric deposition, contaminated sediment, and land uses that generate polluted runoff like agriculture, urban land development, forestry, construction, and on-site sewage disposal systems. Nonpoint source pollution also encompasses activities that either change the natural flow regime of a stream or wetland or result in habitat disturbance.
Not attaining – Surface water is not attaining its uses, but a TMDL does not need to be completed because: 1) A TMDL has been approved and is being implemented, 2) Another action is occurring so that the surface water is expected to attain its uses before the next assessment, or 3) The impairment is due to pollution where a pollutant loading cannot be calculated (e.g., hydromodification).
NPDES – National Pollutant Discharge Elimination System
Parameter – A variable, measurable property whose value is a determinant of the characteristics of a system; e.g. temperature, pH, and turbidity are parameters of water.
Phase I – EPA published permit application requirements for Phase I storm water sources on November 16, 1990. The regulations, promulgated on November 16, 1990 (55 FR 47990), require NPDES permits for discharges from two broad categories of storm water discharges: (1) MS4s serving populations of 100,000 or more and (2) discharges associated with industrial activity (including discharges from construction activities disturbing 5 acres or greater of total land area).
Phase II – The Phase II rule requires storm water discharges from small MS4s and small construction sites to be covered under a NPDES permit. Phase II covers "urbanized areas" which are defined as land areas comprising one or more places (central places) and the adjacent densely settled surrounding areas (urban fringe) that together have a residential population of at least 50,000 and an overall population density of at least 1,000 people per square mile. Phase II small construction sites designated by the rule are those that disturb between one and five acres of land. In addition, sites disturbing less than one acre would be subject to regulation if they are part of a larger common plan of development or sale.
Point source – Any discernible, confined and discrete conveyance or collection system (e.g., pipe, channel, culvert, etc.) by which pollutants are or may be discharged.
Pollutant – Fluids, contaminants, toxic wastes, toxic pollutants, dredged spoil, solid waste, substances and chemicals, pesticides, herbicides, fertilizers and other agricultural chemicals, incinerator residue, sewage, garbage, sewage sludge, munitions, petroleum products, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt and mining, industrial, municipal and agricultural wastes or any other liquid, solid, gaseous or hazardous substances (A.R.S. 49-201(28)).
QA/QC – Quality assurance and quality control. A system of procedures, checks, audits, and corrective actions that is used to ensure that all environmental monitoring and sampling, and other technical and reporting activities, are of the highest achievable quality.
QAP – Quality assurance plan
Quality control – Individual procedures, checks, audits, and corrective actions that are taken to ensure that all environmental monitoring and sampling, and other technical and reporting activities are of the highest achievable quality.

RPD – Relative percent difference
Sample – A small amount of water collected from a larger portion intended to show the nature and quality of the rest.
Sampling – The act of collecting samples.
Sediment – Organic or inorganic material that is carried by or is suspended in water and that settles out to form deposits in the storm drain system or receiving waters.
Sensitive receiving water – Impaired and not-attaining waters.
Surface receiving water – A surface water that has a stormwater discharge flowing into it.
Surface water – Also known as are "waters of the United States", which include:

- All waters which are, have been, or could be used for interstate or foreign commerce
- All interstate waters or wetlands
- All lakes, reservoirs, natural ponds, rivers, streams (including intermittent and ephemeral streams), creeks, washes, draws, mudflats, sandflats, wetlands, backwaters, playas (etc.) which could be used by visitors to our state for recreation, from which fish or shellfish could be taken or sold, or which is used for industrial purposes
- All impoundments, wetlands, or tributaries of above waters

(Summarized from Arizona Administrative Code R18-11-101)
TDS – Total dissolved solids
TMDL – Total Maximum Daily Load. A TMDL is the maximum loading on a pollutant basis that a surface water can assimilate and still attain and maintain a specific water quality standard during all conditions. The TMDL allocates the loading capacity of the surface water to point sources and nonpoint sources identified in the watershed, accounting for natural background levels and seasonal variation, with an allocation set aside as a margin of safety.
TPH – Total petroleum hydrocarbons
TSS – Total suspended solids
Turbidity – A cloudy condition in water due to suspended silt or organic matter.
Upstream – Toward the source or upper part of a stream; against the current.
USEPA – United States Environmental Protection Agency
Water quality standards – State-adopted and EPA-approved ambient standards for water bodies. The standards prescribe the use of the water body and establish the water quality criteria that must be met to protect designated uses.
µg – Microgram; equal to 0.000001 gram.
µg/L – microgram per liter; roughly equivalent to a part per billion.

Appendix A

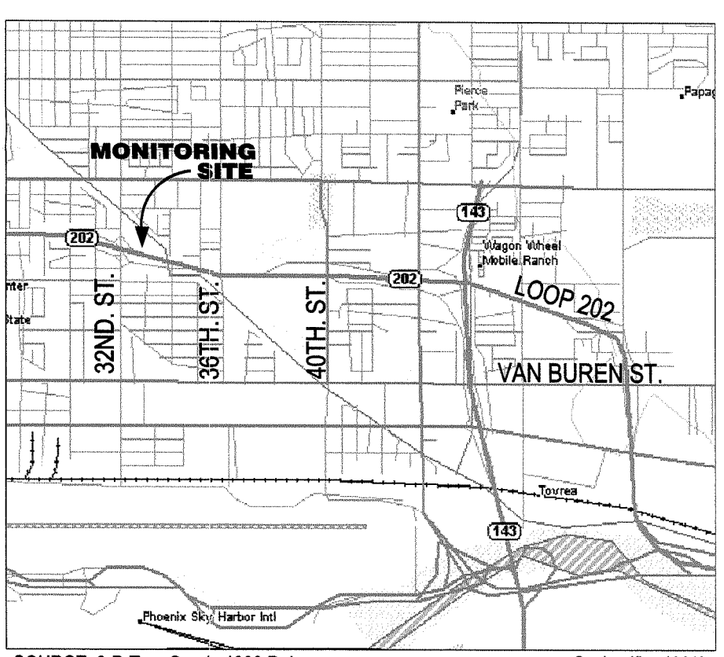
Figures

SOURCE: LANDISCOR AERIAL INFORMATION

400' 0 400' 800'

SCALE: 1" = 400'

N
W E
S



SOURCE: 3-D TopoQuads 1999 Delorme Scale: 1" = 4000'

LOCATION MAP

CONTRIBUTING DRAINAGE AREA FOR MONITORING SITE

eec
Engineering and Environmental Consultants, Inc.
3501 North 16th Street
Phoenix, Arizona 85016
TEL: (602)248-7702 FAX: (602)248-7851

ADOT

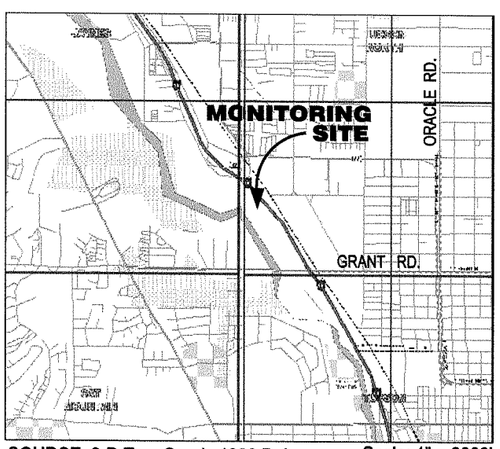
ARIZONA DEPARTMENT OF TRANSPORTATION
NPDES STORM WATER MONITORING SITE
PHOENIX, ARIZONA

FIGURE 1

SOURCE: SAIC/CITY OF TUCSON DEPARTMENT OF TRANSPORTATION 4/98

200' 0 200' 400'

SCALE: 1" = 200'



SOURCE: 3-D TopoQuads 1999 Delorme Scale: 1" = 2000'

LOCATION MAP

Engineering and Environmental Consultants, Inc.
3501 North 16th Street
Phoenix, Arizona 85016
TEL: (602)248-7702 FAX: (602)248-7851

ARIZONA DEPARTMENT OF TRANSPORTATION
NPDES STORM WATER MONITORING SITE
TUCSON, ARIZONA
FIGURE 2

Appendix B

Chain of Custody Form

Lab Number

Customer Number:	Page _____ of _____
Customer	
Address	
City, State, Zip	
Contact	Sampler
Phone	Project Name
FAX	Project Number
P.O. Number	Fax Results Y N
E-mail	E-mail Results Y N

Sample Type Codes

A - Air D - Dust WC - WallChek

B - Bulk W - Water S - Surface Swab

T - Tape Other_____

Sample Information

#	Sample Identification	Date	Type	Analyses Requested ☐ Rush	☐ Rush	☐ Rush	☐ Rush	☐ Rush	☐ Rush	☐ Rush	☐ Rush	Area/ Volume

Instructions/Special Requirements:

	On Account (*must have preapproved credit*)
	Check Enclosed
	Credit Card Payment - (*please check one*) VISA MC AMEX Discover
	Credit Card Number Expiration Date Signature

Date	Time	Samples Relinquished By	Samples Received By

Appendix C

Dry Weather Field Screening Site Report Form

SITE REPORT
DRY WEATHER FIELD SCREEN

Structure Name: _____

Outfall Location Code: _____**L.U.Type** _____

Receiving Water:_____
(water of the U.S., USGS map waters, or ADEQ designated waters)

Access Instructions: _____
(nearest intersection or landmark)

For discrepancies or omissions only:
Outfall type, shape, material, and dimensions (see manual for codes): _____
_____

Vegetative Growth (circle one): none normal excessive growth inhibited growth

(If no flow but excessive or inhibited growth, schedule additional site visit).

1st Visit		**2nd Visit** (>4 hours and <24 hours later)	
Date/Time: _____		Date/Time: _____	
Precipitation <96 hours? Yes / No Flow? Yes / No		Precipitation <96 hours? Yes / No Flow? Yes / No	
pH: : _____su	Color: # _____	pH: : _____su	Color: # _____
Cl2: _____ppm	Ammonia: _____ppm	Cl2: _____ppm	Ammonia: _____ppm
Cu: _____ppm	Oil sheen: Y / N	Cu: _____ppm	Oil sheen: Y / N
Phenols: _____ppm	Surface scum: Y / N	Phenols: _____ppm	Surface scum: Y / N
Deterg: _____ppm	Air Temp: _____°F	Deterg: _____ppm	Air Temp: _____°F
Turbidity: _____NTU	Water Temp: _____°F	Turbidity: _____NTU	Water Temp: _____°F
Attach copy of Chain of Custody Record (see manual for example form)		Attach copy of Chain of Custody Record (see manual for example form)	

Physical Observations (1st Visit):
(circle appropriate descriptors, for "other" write in description)

Deposits: none sediments oily other

Odor: none musty sewage rotten eggs solvent chlorine other

Biological: none fish algae other

Signature: _____

Physical Observations (2nd Visit):
(circle appropriate descriptors, for "other" write in description)

Deposits: none sediments oily other

Odor: none musty sewage rotten eggs solvent chlorine other

Biological: none fish algae other

Signature: _____

1st Visit	**2nd Visit** (>4 hours and <24 hours later)
Use one of the following:	Use one of the following:
A. Free Fall into container: Volume:_____(gal) Time: _____(sec)	A. Free Fall into container: Volume:_____(gal) Time: _____(sec)
B. Channel/pipe Flow (provide sketch): Depth:_____(in) Width: _____(in) Velocity: _____(ft/sec) Discharge estimate: _____(gpm)	B. Channel/pipe Flow (provide sketch): Depth:_____(in) Width: _____(in) Velocity: _____(ft/sec) Discharge estimate: _____(gpm)

Photograph of Outfall (record roll number and exposure number)

Additional Notes (sketch, flow data, observations, specify visit as 1st or 2nd) **:**

Land Use (L.U.) Type: Indicate dominant watershed land use as residential, industrial, commercial, agricultural, mixed , unknown

Appendix D

Data Validation Sheet

Data Validation Sheet

Monitoring Site: _____

Sample Date: _____ Sample Time: _____ Sample Type: *Regular* *Duplicate* *Split*

Analytical Laboratory: _____

(Use the information contained in Table 3 from the monitoring plan to check all sample results)

		YES (√)	NO (√)	REMARKS
All Samples	Did the laboratory analyze all parameters requested on the chain of custody?			
	Were the samples analyzed with the analytical methods specified in the monitoring plan?			
	Were all holding times met by both the monitoring personnel and the laboratory?			
	Were the reported values at or below the reporting limits specified in the monitoring plan?			

(Use the information contained in Table 4 from the monitoring plan to check the QC sample results)

		YES (√)	NO (√)	REMARKS
QC Samples	For duplicate samples: Does sample duplicate precision meet the specified criteria?			
	For split samples: Does sample duplicate precision meet the criteria specified in the monitoring plan?			
	If not, did the laboratories use the same analytical methods?			

Appendix E

Discharge Monitoring Report Form

ARIZONA DEPARTMENT OF TRANSPORTATION

Monthly Discharge Monitoring Report (DMR) Form
for the AZPDES MS4 Individual Permit

PROJECT NAME AND ADDRESS:

COMPLETE AND SUBMIT ONE COPY PER MONITORING POINT EACH MONTH. THIS REPORT MUST BE RECEIVED BY ADEQ NO LATER THAN THE 7TH OF THE FOLLOWING MONTH.

Mail to: Arizona Department of Environmental Quality
Compliance Data Unit
1110 W. Washington
Phoenix, AZ 85007

PERMIT NUMBER	MONITORING POINT ID	MONTH	YEAR

PARAMETERS		Water Temp.						
ANALYSIS TYPE: (Field, Lab, Calculation*)		Field						Calc.*
UNITS		ºC						kg/day
PERMIT LIMITS	Min.							
	Mean							
	Max.							
DAY OF THE MONTH	1							
	2							
	3							
	4							
	5							
	6							
	7							
	8							
	9							
	10							
	11							
	12							
	13							
	14							
	15							
	16							
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	20							
	21							
	22							
	23							
	24							
	25							
	26							
	27							
	28							
	29							
	30							
	31							
Monthly Mean								
Highest Value								
Lowest Value								
No. of Exceedances								

* TMDL Loading Calculations: mg/L x Discharge x 2.4465 :g/L x Discharge x 0.0024465

I certify under penalty of law, that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible forgathering information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

NAME OF PRINCIPAL EXECUTIVE OFFICER

DATE

TITLE OF PRINCIPAL EXECUTIVE OFFICER

TELEPHONE

SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER